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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/700,295 | 11/03/2003 | Michael E. Badding | SP03-079A | 6519 |

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CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

| EXAMINER | |
|---|---|
| WALKER, KEITH D | |
| ART UNIT | PAPER NUMBER |
| 1745 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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| 3 MONTHS | 03/28/2007 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/700,295 | BADDING ET AL. | |
| | Examiner | Art Unit | |
| | Keith Walker | 1745 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *19 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-12 and 29-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 29-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Remarks*

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/19/07 has been entered.

Claims 1-12 & 29-32 are pending examination.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 4-12 & 29-32 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the electrolyte sheet having thicker and thinner areas and the thinner areas becoming progressively thinner closer to the edges, does not reasonably provide enablement for "thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges." The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. The specification does not provide guidance to make the electrolyte sheet with any of an indeterminate amount of changes to the thickness. For instance,

changing the thickness of the sheet so that the edges are progressively thicker than the middle is counterintuitive to the instant specification's teachings ([0104-0106]), since the middle is made thicker to counter act the higher stresses at the middle of the electrolyte sheet. Furthermore, no other types of changes to the thickness in a progressive manner are exemplified or mentioned in the instant specification.

Claims depending from claims rejected under 35 USC 112, first paragraph are also rejected for the same.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 2, 4-12, 29, 30 & 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) and evidenced by *Fuel Cell Systems*.

Regarding claims 1, 2, 4-6 & 9 McElroy discloses a flexible ceramic yttria stabilized zirconia electrolyte with at least one non-uniform surface, where the surface is textured with a plurality of protrusions having a height of 0.5 to 2.5 microns ([0187, 0189]). The components making up the electrolyte are mixed together forming a slurry and then applied to a Mylar film and spread using a doctor blade making a uniform electrolyte structure ([0207]). It is obvious to one skilled in the art the art that this process makes a homogeneous body and it is well known in the art that the electrolyte

is non-porous (Evidenced by Fuel Cell Systems, Pg. 108, Sec. 3.6.2.3). The electrolyte has thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edge (Fig. 13).

When using the electrolyte with one non-uniform surface, the orientation of the non-uniform surface towards which electrode is not discussed. Since only two choices exist, pointing the textured side to the anode or the cathode is seen as a rearrangement of parts, it would have been obvious to one having ordinary skill in the art at the time the invention was made to change the orientation of the electrolyte sheet to optimize the performance of the fuel cell, since it has been held that rearranging parts of an invention involves only routine skill in the art (*MPEP 2144.04*). As pointed out in applicant's specification ([0104]), it is known to have a higher flow of air across the cathode, creating greater compressive force on the high-pressure side (airside) and a greater tensile force on the fuel side. So it is inherent that the fuel cell, taught by McElroy, has a predominately compressive force on the airside and tensile force on the fuel side. The average electrolyte thickness is 10 – 250 microns thick ([0187]). The electrolyte sheet taught by McElroy is made from the same material and has the same thickness as disclosed in the specification. Therefore, it is inherent the electrolyte sheet is bendable to an effective radius of curvature of less than 20 cm and the ohmic resistance is less than 0.2 ohms/cm$^2$. Regarding the ohmic resistance, applicant has not disclosed under what conditions the ohmic resistance is taken. Furthermore, since the ohmic resistance is dependent on the thickness of the electrolyte sheet, it would be obvious to

one skilled in the art at the time of the invention to make the electrolyte sheet thinner to reduce the resistance of the sheet.

Since the protrusions can have any shape, such as triangle, pyramidal or semi-spherical, these geometrical shapes provide an electrolyte sheet where at least 75% of the area of the electrolyte sheet has a thinner body than the rest of the electrolyte sheet.

2. Claims 1, 2, 4-12 & 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2002/0012825 (Sasahara) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent as to which electrode the electrolyte's textured surface faces.

Sasahara teaches an electrolyte with three-dimensional features on one face of the electrolyte (Abstract; Figs. 3 A, B; [0038, 0043]). The three-dimensional features (textured surface) have a depth range of 5 – 500 microns and face toward the cathode side (Figs. 13 A, B; [0019, 0062]). The textured surface provides for a high reaction surface area-to-volume ratio, thereby increasing the volumetric power density. The thinner sections of the electrolyte sheet are textured (Fig. 8, [0020, 0049]). Furthermore, the structural rigidity is improved allowing for a significant decrease in device size ([0014, 0018]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte of McElroy with the textured surface of Sasahara to improve the structural rigidity and the volumetric power density.

3. Claims 8, 9 & 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2001/0044043 (Badding) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent to the electrolyte being non-porous.

Badding teaches the electrolyte as a dense material ([0003]), while the electrodes are described as a porous material. By describing the electrode as being porous and the electrolyte as dense, one of ordinary skill in the art would infer this to be a substantially non-porous body. The dense (non-porous) electrolyte material prevents reactant crossover and the electrolyte thickness enhances the thermal shock resistance and electrochemical performance (4:1-10).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of McElroy with the electrolyte thickness as taught by Bedding, since it would have enhanced the thermal shock resistance and electrochemical performance.

4. Claims 1, 2, 4-12, 29, 30 & 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of JP Publication 05-258756 (Kato) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent as to which electrode the electrolyte's textured surface faces.

Kato teaches texturing the oxidant surface of a fuel cell electrolyte (Abstract, 0022, 0023, 0026]). The texturing allows the expansion of the reaction surfaces between the cathode and the electrolyte, thereby improving the electrochemical reaction of the fuel cell. While the electrolyte between the two references is different, the teaching of texturing the surface of an electrolyte to produce more reactive surface area between the electrode and electrolyte is transferable between the electrolyte types.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify textured electrolyte of McElroy with the teachings of Kato, to arrange the textured surface toward the cathode and produce a larger reactive area for the oxygen reduction reaction.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,521,020 (Dhar) in view of US Publication 2002/0012825 (Sasahara).

The teachings of Sasahara as discussed above are incorporated herein.

Dhar teaches a fuel cell with an electrolyte layer. While the electrolyte layer is not described as being a substantially homogeneously non-porous body, it is well

known to use a non-porous electrolyte to prevent reactant gas crossover. The electrolyte is thicker in the middle and tapers off toward the edges (Fig. 1b; Abstract; 5:5-20). As pointed out in applicant's specification ([0104]), it is known to have a higher flow of air across the cathode, creating greater compressive force on the high-pressure side (airside) and a greater tensile force on the fuel side. So it is inherent that the fuel cell, taught by Dhar, has a predominately compressive force on the airside and tensile force on the fuel side.

Dhar is silent to one side having a textured surface wherein the thickest part is at least 0.5 microns greater than the thinnest part.

Sasahara teaches an electrolyte with three-dimensional features on one face of the electrolyte (Abstract; Figs. 3 A, B; [0038, 0039, 0043]). The three-dimensional features (textured surface) have a depth range of 5 – 500 microns and face toward the cathode side (Figs. 13 A, B; [0019, 0062]). The textured surface provides for a high reaction surface area-to-volume ratio, thereby increasing the volumetric power density. The thinner sections of the electrolyte sheet are textured (Fig. 8, [0020, 0049]). Furthermore, the structural rigidity is improved allowing for a significant decrease in device size ([0014, 0018]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte of Dhar with the textured surface of Sasahara to improve the structural rigidity and the volumetric power density.

***Response to Arguments***

Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keith Walker whose telephone number is 571-272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

K. Walker

MARK RUTHKOSKY
PRIMARY EXAMINER

3.24.07